

PATENT  
RECEIVED  
CENTRAL FAX CENTER

NOV 15 2004

**AMENDMENTS TO THE CLAIMS**

Following is a complete set of claims as amended with this Response. This complete set of claims excludes cancelled claim 26 and includes amended claims 1-3, 5, 6, 8-12, 15, 17-19, 21, 22, 24 and new claims 27-30.

1. (Currently Amended) An implantable cardiac stimulation device comprising:  
a first sensor that is capable of sensing intrinsic cardiac activity and generating corresponding signals;  
circuitry that is connected to the sensor to receive signals from the sensor,  
wherein the circuitry is operative to process the signals to determine an intrinsic heart rate;  
a second sensor that is capable of sensing a physiologic parameter;  
circuitry that is connected to the second sensor and that is operative to determine a potential sleep apnea condition based on the sensed physiologic parameter;  
one or more pulse generators that are capable of generating cardiac pacing pulses to be delivered to the patient; and  
a control circuit that is responsive to detection of the potential sleep apnea condition to control the one or more pulse generators to pace at an overdrive pacing rate based on the intrinsic heart rate to prevent sleep apnea.

2. (Currently Amended) An implantable cardiac stimulation device according to Claim 1 wherein the control circuit comprises an executable control logic that includes a logic capable of detecting a sleep condition, and a logic capable of controlling the one or more pulse generators with a timing based on the sensed intrinsic ~~cardiac-electrical phenomena~~ heart rate to overdrive the intrinsic ~~cardiac-electrical phenomena~~ heart rate to prevent sleep apnea.

## PATENT

3. (Currently Amended) An implantable cardiac stimulation device according to Claim ~~[[1]]~~ 27 wherein the control circuit comprises an executable control logic that detects a sleep apnea condition and controls the one or more pulse generators with a timing based on the sensed intrinsic ~~cardiac electrical phenomena~~ heart rate and is capable of terminating the detected sleep apnea condition.

4. (Original) An implantable cardiac stimulation device according to Claim 1 wherein the control circuit comprises an executable control logic including a logic for detecting a sleep condition based on the physiological parameter, and a logic capable of controlling the one or more pulse generators with a timing based on the sensed intrinsic ~~cardiac electrical phenomena~~ heart rate to overdrive the intrinsic cardiac electrical phenomena to prevent sleep apnea.

5. (Currently Amended) An implantable cardiac stimulation device according to Claim ~~[[1]]~~ 27 wherein the control circuit comprises an executable control logic that detects a sleep apnea condition based on the sensed physiological parameter and controls the one or more pulse generators with a timing based on the sensed intrinsic ~~cardiac electrical phenomena~~ heart rate that is capable of terminating the detected sleep apnea condition.

6. (Currently Amended) An implantable cardiac stimulation device according to Claim ~~6~~ 5 wherein the ~~abnormal breathing pattern is indicative of~~ second sensor detects Cheyne-Stokes respiration.

7. (Original) An implantable cardiac stimulation device according to Claim 1 further comprising:

a sensor implantable into a chamber of the heart that is capable of sensing intrinsic electrical phenomena; and

## PATENT

a pulse generator of the one or more pulse generators that is capable of generating pacing pulses based on timing of the sensed intrinsic electrical phenomena to dynamically overdrive the intrinsic electrical phenomena, the generated cardiac pacing pulses being capable of preventing sleep apnea.

8. (Currently Amended) An implantable cardiac stimulation device according to Claim 1 wherein the control circuit comprises an executable control logic that is capable of distinguishing between a rest or sleeping condition and a waking condition of a patient based on the physiological parameter, confirming a precursor to a sleep apnea condition based on the physiological parameter, and generating pacing pulses based on timing of the sensed intrinsic ~~cardiac electrical phenomena~~ heart rate to dynamically overdrive the intrinsic cardiac electrical phenomena, the generated cardiac pacing pulses being capable of preventing sleep apnea.

9. (Currently Amended) An implantable cardiac stimulation device according to Claim 1 further comprising:

an impedance sensor that is capable of sensing one or more respiration parameters; and

wherein the control circuit is coupled to the one or more pulse generators and to the impedance sensor, the control circuit comprising an executable control logic that is capable of distinguishing between a sleeping condition and a waking condition of a patient based on the one or more respiration parameters, and generating pacing pulses based on timing of the sensed intrinsic ~~cardiac electrical phenomena~~ heart rate to dynamically overdrive the intrinsic cardiac electrical phenomena, the generated cardiac pacing pulses being capable of preventing sleep apnea.

## PATENT

10. (Currently Amended) An implantable cardiac stimulation device according to Claim [[1]] 28 further comprising:

an oxygen sensor that is capable of measuring blood oxygen concentration; and wherein the control circuit is coupled to the one or more pulse generators and to the impedance sensor, the control circuit comprising an executable control logic that is capable of detecting a sleep apnea condition of a patient based on a blood oxygen concentration indicative that blood oxygen level is depressed during sleep, and generating pacing pulses based on timing of the sensed intrinsic ~~cardiac electrical phenomena~~ heart rate to dynamically overdrive the intrinsic ~~cardiac electrical phenomena~~ heart rate, the generated cardiac pacing pulses being capable of terminating sleep apnea.

11. (Currently Amended) An implantable cardiac stimulation device according to Claim [[1]] 27 further comprising:

a carbon dioxide sensor that is capable of measuring blood carbon dioxide concentration; and wherein the control circuit is coupled to the one or more pulse generators and to the impedance sensor, the control circuit comprising an executable control logic that is capable of detecting a sleep apnea condition of a patient based on a blood carbon dioxide concentration indicative that blood oxygen level is depressed during sleep, and generating pacing pulses based on timing of the sensed intrinsic ~~cardiac electrical phenomena~~ heart rate to dynamically overdrive the intrinsic cardiac electrical phenomena, the generated cardiac pacing pulses being capable of terminating sleep apnea.

## PATENT

12. (Currently Amended) An implantable cardiac stimulation device comprising:  
a sensor that is capable of sensing intrinsic cardiac electrical phenomena;  
a heart rate determination device that is connected to the sensor and is operative to determine an intrinsic heart rate based on the sensed intrinsic cardiac electrical phenomena;  
circuitry that is capable of generating cardiac pacing pulses at an overdrive pacing rate based on the intrinsic heart rate; and  
a sleep apnea determination device that is operative to determine when a potential sleep apnea condition exists, and that is responsive to the potential sleep apnea condition to control the circuitry to generate pacing pulses at the overdrive pacing rate to prevent sleep apnea.

13. (Original) An implantable cardiac stimulation device according to Claim 12 wherein the sleep apnea determination device comprises a controller that comprises an executable control logic that includes a logic capable of detecting a sleep condition, and a logic capable of controlling one or more pulse generators with a timing based on the sensed intrinsic cardiac electrical phenomena to overdrive the intrinsic cardiac electrical phenomena.

14. (Original) An implantable cardiac stimulation device according to Claim 12 further comprising:  
a physiological sensor that is capable of sensing a physiological parameter; and  
wherein the sleep apnea determination device comprises a controller coupled to the sensor, the controller comprising an executable control logic that detects a sleep apnea condition based on the sensed physiological parameter and controls one or more pulse generators with an overdrive pacing rate based on the sensed intrinsic cardiac electrical phenomena.

## PATENT

15. (Currently Amended) An implantable cardiac stimulation device according to Claim [[12]] 29 further comprising:

a physiological sensor that is capable of detecting an abnormal breathing pattern;  
and

wherein the sleep apnea determination device comprises a controller coupled to the physiologic sensor, the controller comprising an executable control logic that detects the abnormal breathing pattern and controls one or more pulse generators with a timing based on the sensed intrinsic cardiac electrical phenomena.

16. (Original) An implantable cardiac stimulation device according to Claim 15 wherein the abnormal breathing pattern is indicative of Cheyne-Stokes respiration.

17. (Currently Amended) An implantable cardiac stimulation device according to Claim [[12]] 29 further comprising:

an impedance sensor that is capable of sensing one or more respiration parameters; and

wherein the sleep apnea determination device comprises a controller coupled to the impedance sensor, the controller comprising an executable control logic that is capable of detecting a sleep apnea condition of a patient based on the one or more respiration parameters, and generating pacing pulses based on timing of the sensed intrinsic cardiac electrical phenomena to generate dynamic overdrive pacing pulses.

18. (Currently Amended) An implantable cardiac stimulation device according to Claim [[12]] 29 further comprising:

an oxygen sensor that is capable of measuring blood oxygen concentration; and  
wherein the sleep apnea determination device comprises a controller coupled to the impedance sensor, the controller comprising an executable control logic that is capable of detecting a sleep apnea condition of a patient

## PATENT

based on a blood oxygen concentration indicative that blood oxygen level is depressed during sleep, and generating pacing pulses based on timing of the sensed intrinsic cardiac electrical phenomena to dynamically overdrive the intrinsic cardiac electrical phenomena, the generated cardiac pacing pulses being capable of terminating sleep apnea.

19. (Currently Amended) A method of operating an implantable cardiac stimulation device comprising:  
monitoring cardiac activity;  
determining an intrinsic heart rate based on the monitored activity;  
monitoring a physiologic parameter for a potential sleep apnea condition; and  
generating overdrive pacing pulses at an overdrive pacing rate in response to determining a potential sleep apnea condition, wherein the overdrive pacing rate is based on the intrinsic heart rate to prevent sleep apnea.

20. (Original) A method according to Claim 19 further comprising:  
detecting a sleep condition; and  
generating the overdrive pacing pulses upon detecting the sleep condition.

21. (Currently Amended) A method according to Claim [[19]] 30 further comprising:  
detecting a sleep apnea condition; and  
generating the dynamic overdrive pacing pulses upon detecting the sleep apnea condition.

22. (Currently Amended) A method according to Claim [[19]] 30 further comprising:  
detecting Cheyne-Stokes respiration; and  
generating the overdrive pacing pulses upon detecting the Cheyne-Stokes respiration.

## PATENT

23. (Original) A method according to Claim 19 further comprising:  
sensing a physiological parameter;  
distinguishing between a sleeping condition and a waking condition of a patient  
based on the sensed physiological parameter;  
generating cardiac pacing pulses based on timing of the sensed intrinsic cardiac  
electrical phenomena; and  
dynamically overdriving the heart.

24. (Currently Amended) An implantable cardiac stimulation device comprising:  
means for determining an intrinsic heart rate;  
means for detecting a potential sleep apnea condition; and  
means for overdrive pacing the heart at a rate based on the intrinsic heart rate in  
response to detection of a potential sleep apnea condition to prevent sleep  
apnea.

25. (Original) An implantable cardiac stimulation device according to Claim 24  
wherein the means for detecting a potential sleep apnea condition comprises means for  
detecting a sleep condition.

26. (Cancelled)

27. (New) An implantable cardiac stimulation device comprising:  
a first sensor that is capable of sensing intrinsic cardiac activity and generating  
corresponding signals;  
circuitry that is connected to the sensor to receive signals from the sensor,  
wherein the circuitry is operative to process the signals to determine an  
intrinsic heart rate;  
a second sensor that is capable of sensing a physiologic parameter;



## PATENT

circuitry that is connected to the second sensor and that is operative to determine a potential sleep apnea condition based on the sensed physiologic parameter;

one or more pulse generators that are capable of generating cardiac pacing pulses to be delivered to the patient; and

a control circuit that is responsive to detection of the potential sleep apnea condition to control the one or more pulse generators to dynamically overdrive the intrinsic heart rate.

28. (New) An implantable cardiac stimulation device according to Claim 27 further comprising:

an impedance sensor that is capable of sensing one or more respiration parameters; and

wherein the control circuit is coupled to the one or more pulse generators and to the impedance sensor, the control circuit comprising an executable control logic that is capable of distinguishing between a sleeping condition and a waking condition of a patient based on the one or more respiration parameters, and generating pacing pulses based on timing of the sensed intrinsic heart rate to dynamically overdrive the intrinsic cardiac electrical phenomena, the generated cardiac pacing pulses being capable of preventing sleep apnea.

29. (New) An implantable cardiac stimulation device comprising:

a sensor that is capable of sensing intrinsic cardiac electrical phenomena;

a heart rate determination device that is connected to the sensor and is operative to determine an intrinsic heart rate based on the sensed intrinsic cardiac electrical phenomena;

circuitry that is capable of generating cardiac pacing pulses at a dynamic overdrive pacing rate based on the intrinsic heart rate; and

## PATENT

a sleep apnea determination device that is operative to determine when a potential sleep apnea condition exists, and that is responsive to the potential sleep apnea condition to control the circuitry to generate pacing pulses at the dynamic overdrive pacing rate.

30. (New) A method of operating an implantable cardiac stimulation device comprising:

- monitoring cardiac activity;
- determining an intrinsic heart rate based on the monitored activity;
- monitoring a physiologic parameter for a potential sleep apnea condition; and
- generating dynamic overdrive pacing pulses at a dynamic overdrive pacing rate in response to determining a potential sleep apnea condition, wherein the dynamic overdrive pacing rate is based on the intrinsic heart rate.